Beyond functionality and technocracy: creating human involvement with educational technology

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Abstract

Innovation of education is highly topical. It is obviously boosted by a range of new technologies, which enable new modes of learning that, are independent of time and place through Web-based delivery and computer-mediated communication. However, innovators in education often encounter intrinsic conservatism or even deliberate obstructions. For innovators it is important to be aware of and to understand the basic premises underlying the idea of innovation. This paper explains the origins of technological optimism and the associated faith in progress. Also, techno-pessimism as rooted in the negative side effects of the industrial revolution is reviewed. To solve the conflict between techno-optimism and techno-pessimism we elaborate Borgmann's "devices paradigm": in order to avoid apathetic and indifferent consumption of technology-based commodities, users of technological devices should be given the opportunity to develop substantial involvement with the technological devices. While extending this idea to educational technologies, we present an explanatory model for the mediating role of technological artefacts. In conclusion, we explain how to approach technology-based innovations in education by arguing for transparent and interactive devices, for products as carriers of meaning, for values that harmonise with the characteristics of man and for a mixed mode of developing new ideas and preserving former achievements.

Keywords

Information and communication technologies, Learning technology, E-learning, Online learning, Philosophy of innovation

Introduction

More and more, schools and universities present themselves as innovative educational institutes. Web-based learning environments, free laptops, free and fast Internet connectivity and other information and communication technologies (ICT) are expected to entice prospective students to subscription (see the homepages of several universities, www.ou.nl, http://www.psu.edu, http://www.ubc.ca, amongst others). Education is labelled "new", "different" and "better" as if it were washing-powder. ICT is assumed to be the panacea that is to enable all this: logging in from the students' homes, even in the middle of the night, all learning resources at one's elbow, downloading tools, submitting projects, distance coaching.

Certainly, new technologies are a driving force for innovation. Yet, behind the façade, educational innovators are often struggling with their teething troubles. ICT is complex and confusing, and it deeply encroaches on the processes of education. Lack of vision, lack of consensus and lack of policy on how to integrate ICT in education consistently, aren't very helpful either (Bates, 1995, 2000). Also, students often express their doubts about the benefits of ICT (Poelmans, Joosten & Westera, 2002). As a result, things tend to remain largely the way they are.

This paper discusses how we should use technology to innovate and improve education. We will put forward and substantiate the proposition that innovators should broaden their horizon and consider technology as a societal phenomenon that radically affects human functioning. Educational innovators should go deeply into the question how new technologies, such as the telephone, the car or TV affect human functioning: how does technology determine the way humans experience reality and the way they arrange their lives? Without these insights, innovators will never be able to surpass the level of superficial and seductive effects of ICT as promoted in publicity campaigns. In this paper we will go into the nature, the origins and the premises of technology-based

innovations. We will present an explanatory model for the mediating role of technological artefacts in human functioning and explain how to approach technology-based innovations in education.

Intrinsic conservatism

Education is known for its conservatism rather than its disposition to innovate. (Kaufman, 1998; Westera, 2003). In the last decades, new technologies in education allowed for various sophistications and improvements, but never changed the basic idea of classroom teaching (Sloep & Westera, 2001). There are various reasons for this conservatism. Clearly, schools and universities want to stick to well-tried methods, because uncertain experiments conflict with the task to lead thousands of students through their exams in time. While computer-assisted learning could be fit into the curricula quite easily to substitute only a specific part of a course, the topical introduction of ICT, for instance a web-based learning management system, has large implications on both the institutional infrastructure and the organisation (Bates, 2000; Westera, 2003). This makes the introduction of ICT a costly, complex and uncertain operation, which calls up many hesitations. In addition, education is all about consolidation and transfer of existing knowledge, skills and attitudes from one generation to the next; this gives conservatism a natural basis in education. Educational staff is a product of the educational system itself and is probably pervaded with common patterns and role models (Westera, 1999). All this makes educational innovation a perilous undertaking.

The need to innovate

There are two important motives for educational innovation (Westera, 1999). First, in a continually changing society education has to change as well. The branch of education has to innovate its programmes in order to keep up with rapidly changing demands of society. The modish but pivotal term here is the “information society” (Toffler, 1980) or rather “knowledge society”, referring to the ever-growing importance of knowledge as a means of production. This development gives rise to continuously changing demands upon employees. These can no longer be considered ignorant labourers who carry out routine jobs, but are expected to be proactive, enterprising, responsible and self-reliant professionals. They should be competent and flexible team players that are able to apply and share their expertise in service of shared goals and to adapt their expertise continually to new insights and developments (Barnett, 1994; Walton, 1985). Secondly, innovation is necessary to keep up with other educational providers. Internal processes should be arranged better, faster, and cheaper in order to serve students adequately. Indeed, new technologies, like Web-based learning management systems, might improve the providers’ service levels against reduced cost. Bates (1995) blames the fixated organisational model of classroom teaching and passes a scathing judgement on the role of teachers. According to Bates, teaching as such is not professionalised. It rarely uses a design and it has hardly been influenced by research into instructional design, psychology of learning or other topics concerning human functioning. Teaching remains largely craft-based, while favouring the (pre-medieval) model of apprenticeship learning. As a consequence, it hardly allows for any division of labour to increase the efficiency. Indeed, educational institutes fairly resemble a collection of distinct one-man shops. Because other organisational models are rarely considered, the innovation effort is just additional to regular work and readily leads to increased unit costs. This is exactly what can be observed with the introduction of campus-wide learning management systems (Jörg, Admiraal & Droste, 2002). From an economical perspective, such schools and universities are destined to “pine away” on the market of educational service providers, because of poor performance, bad quality education and disproportionately high cost.

Some authors (Kaufman, 1998; Kearsley, 1998) blame educational technologist for not fulfilling the high expectations. During the last decades, educational technologies indeed comprise many failures: film, school-TV, instructional video, courseware and multimedia never fulfilled their promises. According to Kaufman, educational technology failed to substantiate the claims and kept supporting the common teacher-centred pedagogy. As a consequence many teachers receive new technologies with reserve (Sloep & Westera, 2001).

The innovation drive

To understand the contradiction between conservatism and innovation it is necessary to look beyond straightforward, opportunist and superficial reasons for innovation and investigate the intrinsic motives and premises that drive us to innovation. Humans are essentially creative beings that continuously come up with new ways to do things better, easier or faster. The wheel, the alphabet, mathematics, …. it is essentially the ideas that

make up our culture. Indeed, civilisations are determined by ideas rather than biological or physiological aspects of human life: civilisations differ precisely in the ideas that compose them and that make them develop in different ways. In essence, "…civilisation is ideas and no more than ideas" (von Mises, 1957). Richness of ideas is a unique human feature that strongly corresponds with innovative power. Therefore innovation is a phenomenon that is inextricably bound up with humankind.

Over the last centuries innovative efforts have produced impressive achievements: sophisticated medical cures, agricultural methods, new modes of transport, communication media, information technologies etc. These keep fostering the optimism for prosperity, increasing standards of living or, in a broader sense, better conditions of life. The cradle of the optimism goes back to the Enlightenment, an intellectual movement in the seventeenth and eighteenth century that strongly influenced the portrayal of mankind. It is the era of great scientists, philosophers and writers, like Descartes, Newton, Leibnitsch, Locke, Kant, Voltaire and Diderot. They claim that man is rational and good by nature. Also Darwin should be mentioned, whose theory of evolution reflected the conflict between science and religion, while it rejected the idea of creation of life according to the Bible book of Genesis. Rather than the creationist belief that every species was created individually by God and is not subject to change or progress, it claimed that life has developed in a progressive way from primitive forms to complex organisms. The Enlightenment marked the liberation from the medieval doctrines of magic, superstition, prejudices and the fear of God by replacing it with human rationality. The fear of God makes way for a scientific description and explanation of the world. Beliefs are not anymore accepted on the authority of priests, sacred texts, or tradition, but only on the basis of reason. Reinforced by the idea of natural regularity and material cause the Scientific Revolution successfully proclaimed the ideology of upward development, progress and improvement of the world, encouraged by an ever-increasing knowledge, understanding and control of nature's processes. It asserts that the individual as well as humanity as a whole can progress to perfection. Indeed, tangible results are omnipresent, be it only for part of the world population.

Innovation and culture

The simple notion that innovation implies progress and leads to a "better" world, unmistakably reflects the values of our modern society. To mention a few: economy of growth, capitalism, materialism, competition, techno-optimism and scientific positivism. Being tightly linked with the starting points of modern (western) society, innovation is necessary condition for all economic functioning. Innovations further the creation of new products, services and production processes, which will provide an economic actor with an advantage over its competitors. The predominant motto is "innovate or pine away" and the concepts of growth, progress, innovation and change seem to have become self-evident. Indeed, according to Charles Darwin and Jean-Baptiste Lamarck, survival depends on our ability to change. Abandoning innovation means stagnation, stagnation means decline. The decline doesn't only concern our economy but will affect our culture as a whole. Innovation is not straightforward. It is inevitable within the constraints of our societal system.

Criticism on rationalism

Enlightenment's rationalism has been subject of severe criticism. Opponents claim that rationalism's unconstrained belief in progress and its focus on human reasoning isn't capable of describing and understanding the nature of human emotions, feelings, moral and ethics (Husserl, 1913; Jaspers, 1931; Heidegger, 1977; Hickman, 1990). The strict depreciation of non-rational aspects of man disregards what probably is the predominant factor of human functioning. Consequently, the concept of progress is not applicable to happiness, compassion and other states of mind. Put differently, progress does not imply that modern man is happier or more compassionate than his ancestors were. In rationalism education is restricted to cognitive development, emphasising knowledge rather than attitudes and competence development (Westera, Sloep & Gerritsen, 2000). Important determinants of learning, like motivation, perseverance and commitment are neglected, which greatly contrast with contemporary views on learning. Also, the absolute rejection of beliefs on authority disregards the knowledge that has accumulated during past generations. Such a strategy would be very ineffective and would rarely lead to high levels of expertise.

Techno-pessimism

Innovators are often accused of promoting decline rather than progress. Negative side effects like vanishing nature, depletion of fossil fuels, pollution of water, soil and air, not to mention the uncontrollable threat of

biological, chemical and nuclear armament are an easy breeding ground for techno-pessimism and a glorification of the past. Some schools deliberately avoid the term innovation and prefer to emphasise traditional values like order, discipline, and perseverance (for example English boarding schools).

Scepticism against new technologies arose in the 19th century, when the negative effects of the industrial revolution painfully became manifest. In a gloomy analysis, the existentialist Jaspers (Jaspers, 1931) advocated his alienation thesis: technology creates a totally new material environment and causes human beings to become alienated from the world. In this era of the industrial revolution, human craftsmen were increasingly replaced by machines that not only made production faster and cheaper but also allowed for the mass production of objects that met constant quality standards. In highly rationalised and controlled production processes, human workers were degraded from unique individuals to interchangeable workers, destined to be just a cog in the machine. In addition to this, the highly bureaucratic organisational form made people dissolve in their functional roles rather than supported human identity and individuality. Through this mass production, human individuals became more and more ignorant of the origin, composition or functioning of industrial products, be it food, clothes or consumer electronics. Prevailing values like economy, frugality and sustainability lost ground because of the availability of many identical and exchangeable duplicates: indeed, broken products could be easily replaced with a new specimen. People were thus trapped in a pattern of passively fulfilling their material needs by ever-replaceable stuff that was abundantly available (Verbeek, 2000). In this view, inspired by the negative effects of the industrial revolution, technology seemed to have become a power in its own right (Ellul, 1964), that controlled society autonomously and alienated human individuals from the world and from themselves.

Many of these patterns can still be observed today: the inescapable way technology enters our lives and makes us dependent, our fixation on material needs and the resistance of teachers who's well-respected role of craftsmen is gradually degraded to that of a cog in the machine (Heinich, 1984). Yet, Jaspers' instrumental view doesn't quite come up to the mark to describe technology's role in the digital age: the idea of labourers in mass production differs significantly from the present situation of highly skilled and autonomous knowledge workers. The instrumental view, which reduces humans to simple toolmakers and tool users, doesn't adequately describe technology's interaction with today's society (Hickman, 1990).

Technology's mediating role

From the 20th century, technology is no longer considered a mere instrument of industrial innovation. It is interpreted from the idea that technology makes up an integral part of life and fundamentally alters the way we experience reality. Husserl (1913), Heidegger (1977) and other phenomenologists considered technology by investigating its role in the way individuals perceive and experience the world and interpret it by attaching meaning to it. They investigated how our material environment determines our identity and how it changes the way we arrange our life. In their view, technology has no "essence" as such, but can only be understood by considering the context of its use. In fact, technology is assumed to mediate and give form to the relationship that individuals have with the world they experience. Television, for instance, creates new ways to open up reality. To evaluate the role of television, it is not sufficient to consider only its technical and functional characteristics. It is necessary to include its context of use and to consider its impact on the human experience. Put differently, technology has to be analysed by linking the object of experiences (the world) with the subject of experience (the individual). It thus overcomes the dichotomy between object and subject as claimed by Descartes and his fellow rationalists and replaces it with their mutual involvement: object and subject are assumed to constitute each other. As McLuhan (1964) and Postman (1986) demonstrated, television is not just an information channel that is additional to books, newspapers or lectures. It fundamentally changes the way we experience and interpret the world. Such a phenomenological view, however, doesn't seem to make the observations less gloomy. Fromm (1941), McLuhan (1964), Postman (1986) and Baudrillard (1995) criticised the role of modern mass media (radio, television, Internet), which incoherent flow of trivialities is supposed to reinforce a primitive and fragmented view on the world (the "zap" culture). In their view, such a technological innovation is only material in nature and supports the loss of human capabilities like commitment, reflectivity and profundity.

Web-based education is open to the same risks; fragmentation, shallowness and alienation lie in wait. In accordance with Postman's and Baudrillard's objections tot mass media, hypertexts as presented on the web often lead to unwanted disorientations (Bruer, 2003), which makes in-depth and coherent study of separate texts via the web problematic. Also, with all worldwide answers within reach, it is tempting to switch off thinking (Baudrillard, 1995): learning may easily coincide with the random and impulsive collection of data which first appearance is more important than its significance. This would promote the unconcerned citation of sources and

would hamper the acquisition of insights and understanding. It bears the risk of a technology-based "innovation" that promotes decline rather than progress.

How to innovate?

So far, the interpretation of technology-induced change is quite a gloomy affair. Indeed, techno-optimism and belief in progress are greatly challenged by various philosophical movements. With technology, it seems, man is doomed to self-destruction and will loose all his achievements. If, nevertheless, innovation is marked an essential condition for survival, a deadly contradiction seems to remain: *innovation is inescapable, but will eventually destroy us*. This is an oppressive idea, totally unacceptable for educational innovators – and not only for them. It is necessary to break through this paradox and to look for clues how technology can contribute to our existence in a sensible way. Today, Heidegger's view that technology mediates the relationship between humans and their world, is widely accepted, both by existentialists and phenomenologists. It is inadequate to consider technological products as mere instrumental solutions for practical problems, as Jaspers did. Mistakenly, such technocratic view neglects the psychological and emotional factors that add extra value and meaning to a product. According to Dewey and Hickman (Hickman, 1990), technological tools and instruments are never value-neutral but rather "…teeming with values and potentialities…", which may cause unexpected responses, strongly deviating from the initial intentions. It is just this direction of added values and meanings that provides opportunities to overcome the deadlock. The frugal, technocratic concept of "functionality" is no longer satisfactory to describe and understand the significance of technology. The existentialist Borgmann (1984) approaches this problem at the level of concrete technological devices. Although his "devices paradigm" cannot avoid some gloominess, it seems to produce sensible hints for the favourable application of technology.

The role of devices

Borgmann (1984) cautiously combines both elements of techno-optimism (technology can solve any problem) and Jaspers' alienation thesis (technology detaches us from reality). According to Borgmann, technology promises a relief and enrichment of human existence. It liberates humans from burdens by making available a multitude of goods like heat, light, water, food, information, etc., without any effort whatsoever. In ancient times, our ancestors needed a full day's work to find enough food, gather wood, make fire etc., while today, we dish up a ready-to-eat meal within a few minutes. Those were tough times: lighting the stove required knowledge, but also dedication, perseverance, goal-orientedness and involvement with the tools available. Today, the availability of goods is straightforward, omnipresent, easy, safe and immediate. Heat, light and information become available by simply pressing a button on "technological devices" like central heating, electric lighting and TV-sets. What used to be an achievement has become a simple commodity, which demands no commitment, proficiency and skills acquired by effort, discipline and involvement with the world. The efforts are now taken care of by the device's machinery. In most devices the machinery, i.e. the technology, is deliberately kept out of sight. Who needs light, only needs a switch to turn it on: the machinery of electric wires, wire connectors and cable plugs is hidden behind ceiling and wallpaper. After all, only by "hiding" the machinery and separating it from the commodity, commodities become available in a straightforward and effortless way, that is, without any commitment or skills involved. According to Borgmann, such pattern of separating the commodity from the machinery only leads to apathetic consumption, which is detached from any social or material context and which removes the involvement with the world. Blindfold, we locate and operate the switches that provide us with what we need, without wondering a single moment where this all comes from. Like Jaspers, Borgmann indicates that man is alienating from his world and becomes more and more ignorant of the origin, composition or working of the products he consumes. However, his argument is not mass production, but rather the fact that man has no access to the machinery of products and thus is forced to accept these as magical accomplished facts. He calls on breaking out this technological consumerism not by simply rejecting technology, but by restoring the relationship between the commodity and the machinery. Users of technological artefact should be given the opportunity to develop commitment with it. Devices should preferably be transparent and reveal the secrets of its machinery. To amplify the users' involvement, devices should also be adjustable to personal preferences. By making its machinery accessible, users are able to maintain, repair and adapt the devices. Indeed, from an existentialist view involvement is more important than availability. Borgmann suggests devices that support "focal practices", that is, activities that demand high degrees of involvement, that require discipline, perseverance, concentration and skills, that are physically and mentally challenging and are difficult to master, that provide satisfaction and pleasure, that stimulate rather than discourage our ties with the world and that serve no particular goal other than being a focal practice. Examples of focal practices would be walking (instead of taking the bus), cooking (instead of ordering a pizza), repairing an old bicycle (instead of

buying a new one) or any other activity that demands intrinsic involvement and hence serves the existential relationship with our world.

Toward solutions

Borgmann's idea of focal practices can be easily linked to educational technology. Although educational services are more and more considered as straight commodities that are being delivered and consumed within a commercial framework, it is clear that the acquisition of skills and knowledge by learners requests large commitments. Learners have to be motivated, self-reliant and responsible. They should show intrinsic involvement, they should be completely bound up in the subject and they should in fact to continue learning forever. The learning itself can frankly be labelled a focal practice. This is exactly what lifelong learning means: making the learning a goal as such, acquiring knowledge because of the knowledge, getting wiser and wiser without a clear finish. Also the changing opinions about learning and learning processes fit into the picture. Contemporary views on learning no longer equate learning with the absorption (i.e. consumption) of information, but rather consider it the active (i.e. involved) construction of knowledge by the learners. The suggestion that today's learners are hard to motivate and only interested to pass their exams with the least possible effort may indicate that education evokes too little commitment and thus fosters apathetic consumerism. It is interesting to apply Borgmann's line of thought to the technology-based innovation of education. This will provide guiding principles for educational innovations in practice and may help avoid problems we touched upon earlier in this paper. Figure 1 resumes how a technological artefact mediates the relationship between man and his world.

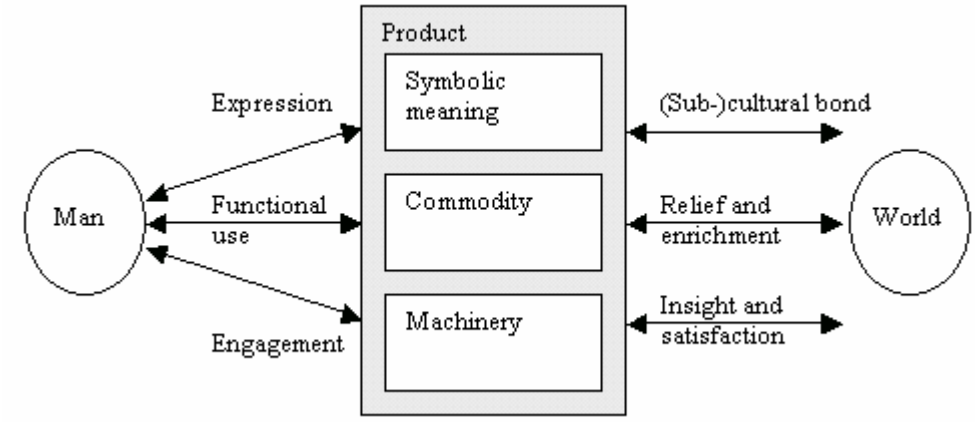

Figure 1. The mediating role of technological artefacts

Three levels of mediation are distinguished:

- *The level of commodity:* In the case of a car, the commodity would be the possibility to travel from A to B. This is the level of functional use, which provides relief and enrichment, i.e. the ease of travelling. In education: a digital portfolio provides easy accessible webspace or folders to store relevant documents.
- *The level of the machinery:* In the case of a car, the machinery comprises the system of mechanical parts and electrical circuits that enable the car to drive. Rather than holding back the machinery from its users, the machinery should be accessible in order to allow for involvement. Involvement with the device's machinery will further insight and satisfaction. In education: the digital portfolio can be configured at will to meet individual preferences.
- *The level of symbolic meaning:* Symbolic meaning is attached to the commodity: a four-wheel drive indicates a different lifestyle or status of the owner than a limousine. This level allows users to express and distinguish themselves; it allows users to become part of a specific subculture. In education: the digital portfolio is made accessible to third persons to display relevant symbolic cues.

In the next paragraphs we will elaborate these levels of mediation and elaborate the connection with educational technology. We will start with the commodity level and then turn to the machinery level and the level of symbolic meaning.

The commodity level: the utilitarian function of technology

This is the predominant level of functional use. It is characterised by an unrestricted pragmatism and goal-orientedness of users, who degrade technology to an instrumental utility, simply a practical means to arrive at an end. Indeed, many learners opt for the easiest way to obtain their course certificates. Such attitude rests on an instrumental approach of technology, which according to Borgmann and Jaspers is likely to cause alienation and apathetic consumerism. Unwittingly, educators seem to promote such attitudes also. Until now, the motto "form follows function" is exemplary in education. It means that anything that doesn't evidently contribute to the achievement of learning goals is resolutely omitted. The motto goes back to the modernism of 1930s, which proclaimed that all products should be modelled after machines: simple and prepared for their function. It represents a rocklike faith in technology and it reflects the ideas of the 19th century's instrumentalism for a great deal. Indeed, educational technology is often regarded a mere instrument ("form") to meet pedagogical demands ("functions"). The virtual classroom would be a good case in point here: transferring traditional pedagogical functions (i.e. the well-established classroom concept) to a new instrumental context (internet technologies). As the complexity of the applied technologies increases, one might wonder to what extent alienation is likely to occur. To stimulate the students' and teachers' involvement they should get access to the virtual classroom's machinery in order to configure preferred settings, to explore the technology's possibilities, to develop new behaviours and, preferably, to create new pedagogical models: technology and pedagogy are assumed to constitute each other.

The "form follows function" motto and its associated instrumentalism has also been criticised by Ellul (1964). Ellul considers technology the defining force of a new social order that is obsessed by the values of rationality, efficiency, usefulness and materialism. Ethical and esthetical considerations seem to play no role whatsoever.

Also in education such trends can be observed: increases in scale, budget reductions and new technologies enlarge the distance between teachers and learners and affect the pedagogical climate. More and more, education shows features of a commodity. Clearly, such development is at odds with the ideas of involvement and focality. To counteract this technocracy, educational technology should extend its values beyond efficiency and functionality: education should be interesting, attractive, entertaining, challenging, pleasing, intriguing or even fatiguing, deterring and only useful as such. This is no plea for inefficiency, but a plea for values that harmonise with the characteristics of man. After all, education can play an important part in the individual's life fulfilment. Along this line of thought, contemporary pedagogies promote critical attitudes, self-determination or independence of learners in order to counteract intellectual consumerism and laziness. Schools that would emphasise the ease of studying (possibly with ICT as enabler) promote the commodity as such.

The machinery level: Transparent and interactive devices

For the design and development of technological artefacts it is important to reveal its machinery to its users (Borgmann, 1984). Devices should be transparent to allow involvement from its users. We distinguish four modes of involvement:

- Sensory involvement
- Conceptual involvement
- Operational involvement
- Material involvement

As a first step sensory involvement should be pursued, which means that the device's machinery is visible, audible or tangible. The next level of involvement would be conceptual in kind: by revealing the machinery's functional components, it becomes clear how the device operates, even when most technologies are often too complex to be fully understood by laymen. At the level of operational involvement it is important that users can practically and diversely interact with the devices, in order to develop their own unique methods and routines of use (cf. a piano). The ultimate level of involvement would be material in kind: by offering accessibility to the machinery, users are enabled to care for it, to maintain it and to carry out repairs and upgrades. Such involvement matches the idea of sustainability and counteracts the pattern of mass consumption, which allows the easy replacement of faulty products with a new, identical specimen. In education, one might think of an electronic learning environment that students can configure and adapt at will, not only with respect to a preferred lay-out or user-interface, but also with respect to the preferred complexity of learning tasks, the sequencing of learning tasks or the levels of support and feedback. Such measures would be consistent with the notions of constructivism that learning is an active process of knowledge construction, that the conditions of learning should be in control of learners rather than teachers and that learners should be able to match their learning

opportunities to their own learning needs. Also, transparency of the instructional design and its motives, underlying the learning tasks and learning materials may readily amplify the student's involvement, insight and motivation. Whenever education becomes a straitjacket, the learners are hindered at developing their focal practice and are compelled to accept (or probably reject) it as a mere commodity.

The level of symbolic meaning: technology as signifier

Instead of opening up a device's machinery in order to enhance the user's involvement, one could also exploit the device's socio-cultural impact, which refers to the symbolic role that products may fulfil by signifying additional meaning. By buying and exhibiting a product, consumers can distinguish themselves from others while they signify a particular lifestyle, preference or subculture. Since the "form follows function"-motto got obsolete in the 1960s, products have become carriers of meaning more and more (Verbeek, 2000). Today, the outward appearance of products has become a decisive asset at the expense of functionality. The association with lifestyle strongly stimulates the involvement of the owner and supports the mediating role of products. Education seems to lag behind many decades by still aiming exclusively at functionality alone and it thus seems to miss the opportunity to enhance the learners' involvement. In accordance with Ellul (1964) educational technology should go "beyond functionality". Education should link its products with symbolic meaning: favourite lifestyles and emotions, even if this idea is just a result of the perhaps detested consumer society and its advertising men. So, it may be wise to upgrade the symbolic value of lifelong learning, because no one wants to be the "loser that spends all his leisure time at the garret, cramming for an exam". Lifelong learners deserve a better image. Establishing such symbolic meaning is more than a sly salesmanship. New educational technologies indeed offer plenty of possibilities to arrive at symbolic meanings that are more attractive. First, the ever-growing importance of knowledge in our society suggests that lifelong learning will be more and more associated with standing and esteem. Secondly, economic inequality between people will no longer be determined by large-scale landownership as it was in the agrarian age, or by capital as it was in the industrial age, but is increasingly established by the degree that people have access to information and communication technologies and the associated opportunities for individuals to search for information, to consult other people or to work together (Soete, 2002). Being a "nerd" may even become worth striving for.

In conclusion

As has been pointed out above, education should be considered a focal practice rather than a mere commodity. Indeed, contemporary views on learning presume learners to be self-reliant, motivated and responsible individuals rather than apathetic consumers. Essential presuppositions for learning like the learners' involvement, discipline, perseverance, reflectivity and independence, can only be accounted for when technology's mediating role is extended to the level of the technology's machinery and the level of symbolic meaning. At the machinery level it is necessary to reveal to the users the mechanisms underlying the technology or even make the machinery accessible and adjustable. Such an approach fosters the users' involvement and amplifies their insight, motivation and satisfaction. For example: students should be allowed to configure and adapt their (electronic) learning environments at will. This creates the students' ideas of ownership and responsibility, and invites to maintain and manage the environment actively. At the symbolic level, educational technology should strive to go "beyond functionality and efficiency" and pursue added values that make education interesting, tough, important, intriguing and the like. Education and its applied technological artefacts should literally be transformed into a way of life. Indeed, new educational technologies offer plenty of possibilities to arrive at relevant symbolic meanings that enable individuals to express and distinguish themselves.

Although the importance of technology-based innovations for society has been demonstrated extensively, it cannot be the ultimate and only ambition. Life demands a mixed mode of developing new ideas and preserving former achievements. Such mixed modes will be necessary in education as well. Not only because knowledge itself is a dynamic construct which covers both state of the art insights and well-established ones, but also because the educational arena is characterised by both new industrial technologies and traditional teaching craftsmanship. The challenge for education is to meet the continually changing needs of society. The sensible application of new technologies is inescapable. As education will fail to fulfil its role in society, it will be torn between the public demand for revolutionary innovations at the one hand and, at the other hand, the demand for regression to former days, when education apparently was successful in educating people.

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